Exhibit Q

Part 1

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Gollnick et al.

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(54) **NETWORK SUPPORTING ROAMING, SLEEPING TERMINALS**

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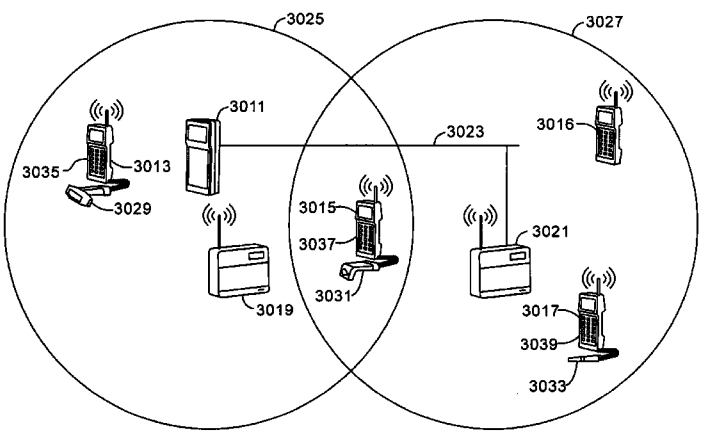

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(74) *Attorney, Agent, or Firm*—McAndrews, Held & Mallow, Ltd.

(57) **ABSTRACT**

Improved apparatus for a radio communication system having a multiplicity of mobile transceiver units selectively in communication with a plurality of base transceiver units which, in turn, communicate with one or more host computers for storage and manipulation of data collected by bar code scanners or other collection means associated with the mobile transceiver units. A network controller and an adapter which has a simulcast and sequential mode provide selective interface between host computers and base transceivers. A scheme for routing data through the communication system is also disclosed wherein the intermediate base stations are organized into an optimal spanning-tree network to control the routing of data to and from the RF terminals and the host computer efficiently and dynamically. Additionally, redundant network and communication protocol is disclosed wherein the network utilizes a polling communication protocol which, under heavy loaded conditions, requires that a roaming terminal wishing to initiate communication must first determine that the channel is truly clear by listing for an entire interpoll gap time. In a further embodiment, a criterion used by the roaming terminals for attaching to a given base station reduces conflicts in the overlapping RF regions of adjacent base stations.

203 Claims, 26 Drawing Sheets

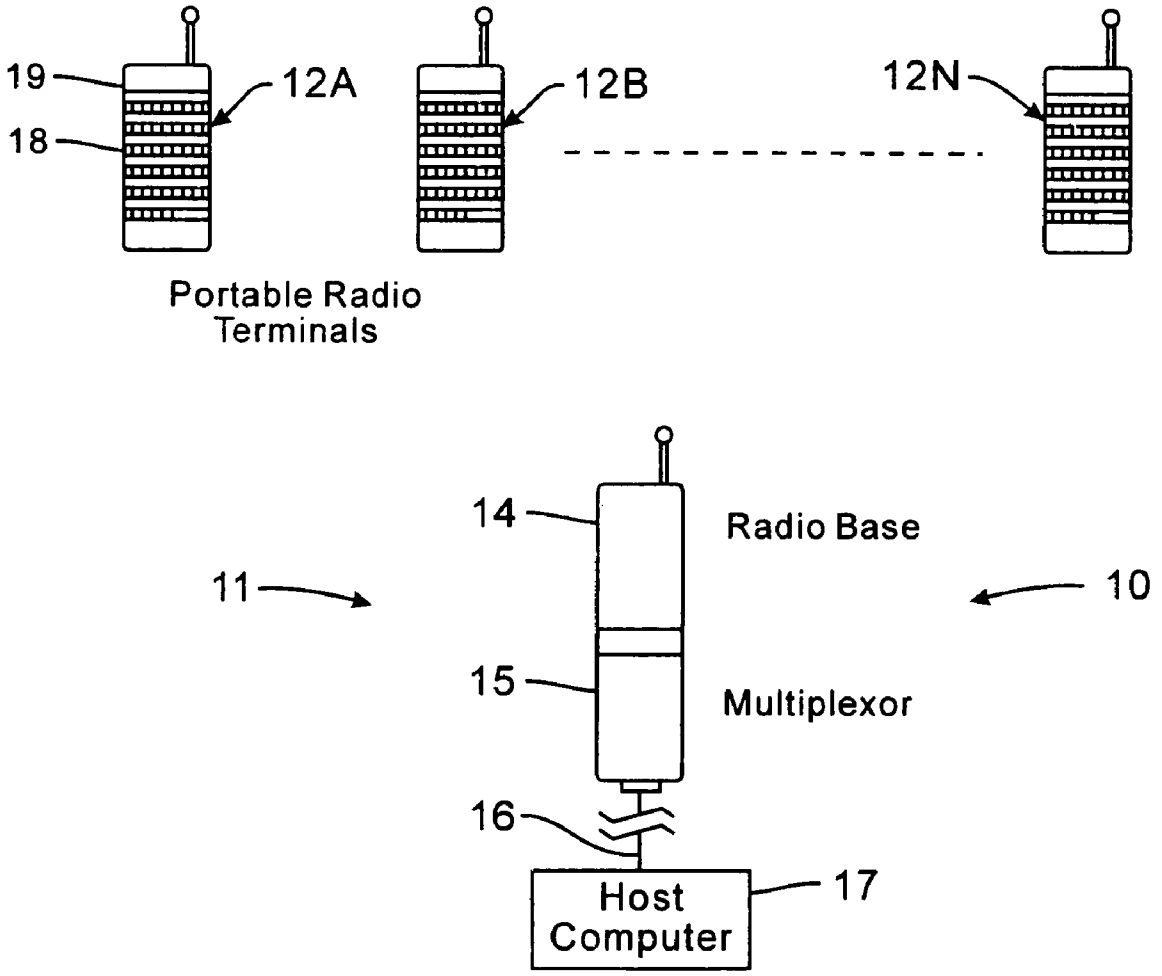

Fig. 1
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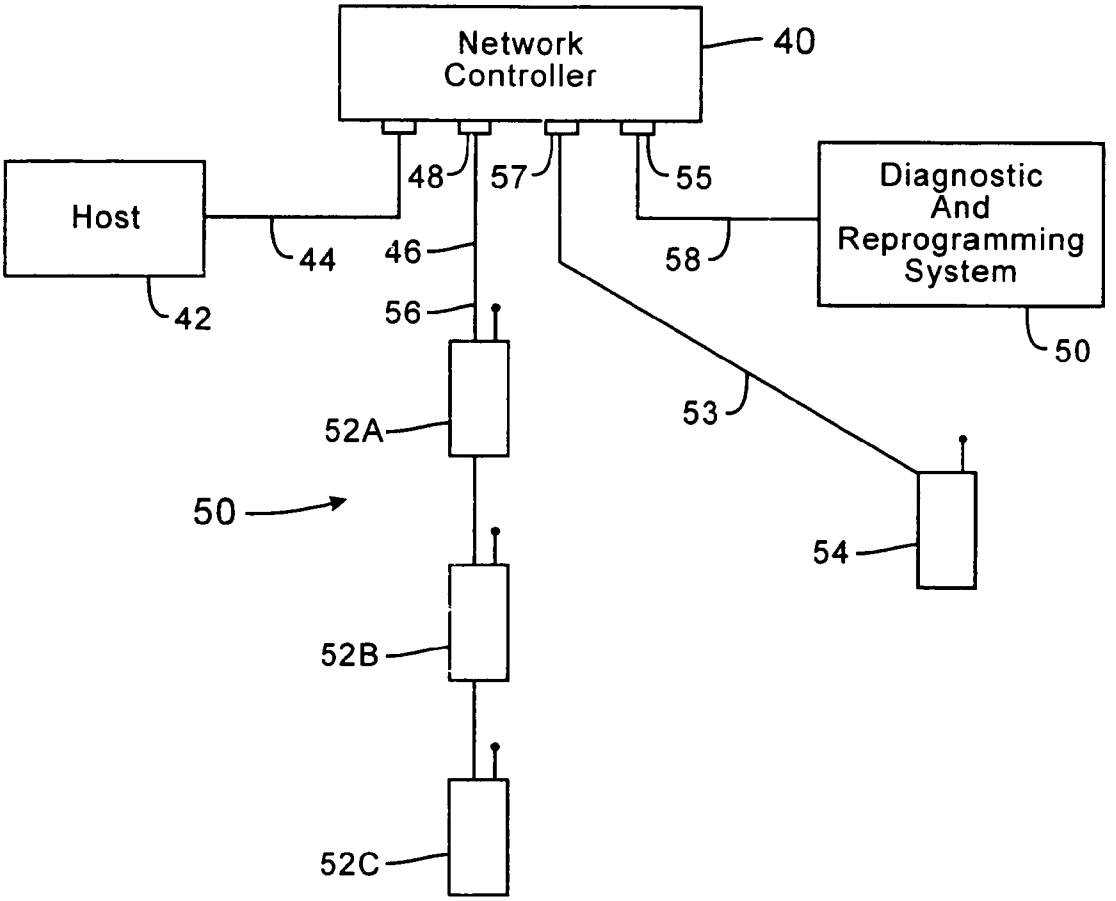
Network Controller
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Host
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Diagnostic And Reprogramming System
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52B
52C

Fig. 3

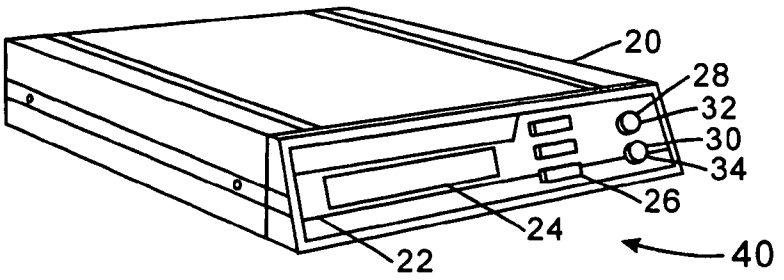
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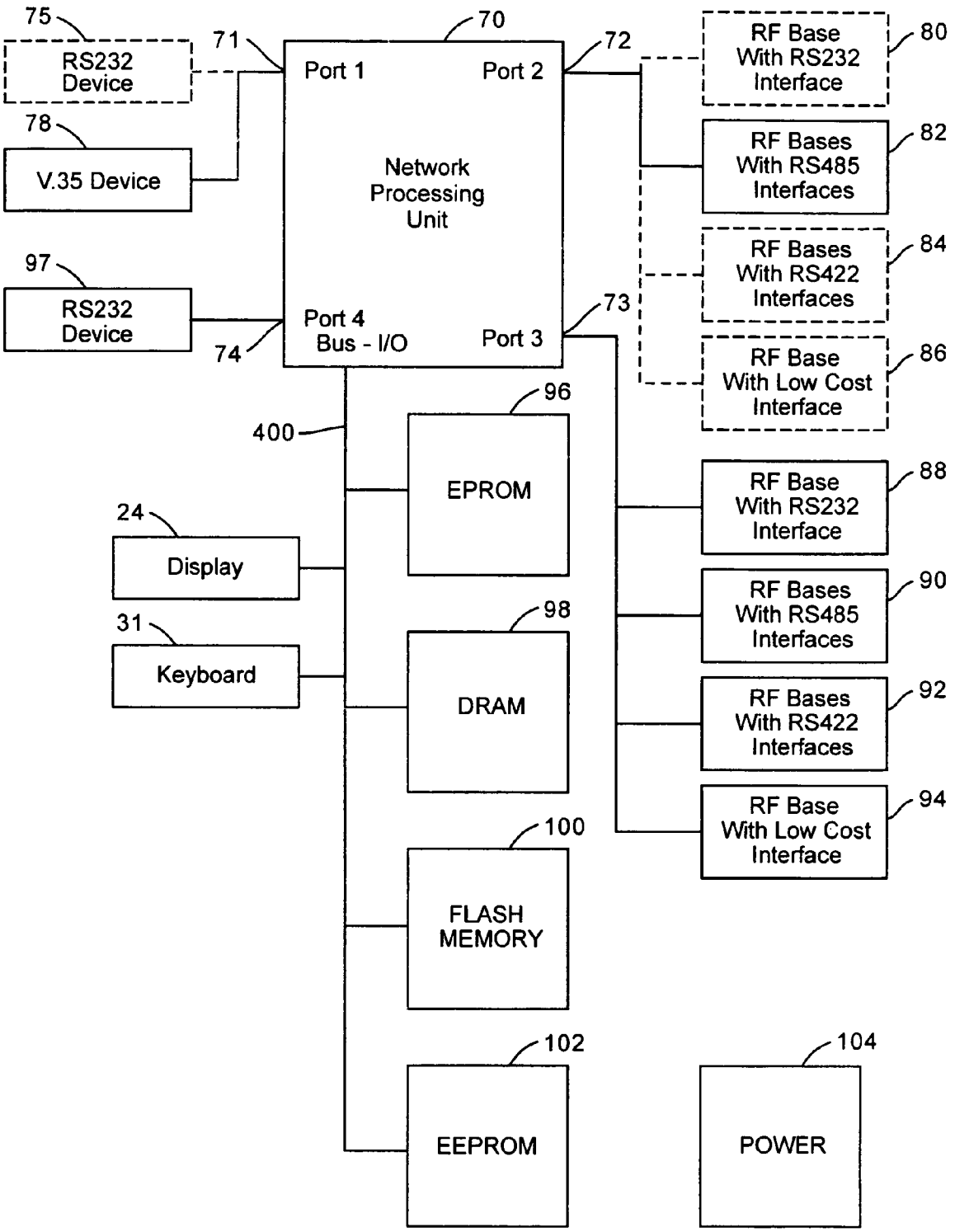
Fig. 2


75
RS232 Device
71
70
Port 1
Port 2
72
RF Base With RS232 Interface
80
78
V.35 Device
Network Processing Unit
RF Bases With RS485 Interfaces
82
97
RS232 Device
RF Bases With RS422 Interfaces
84
73
Port 4 Bus - I/O
74
Port 3
RF Base With Low Cost Interface
86
96
400
EPROM
RF Base With RS232 Interface
88
24
Display
RF Bases With RS485 Interfaces
90
31
Keyboard
98
DRAM
RF Bases With RS422 Interfaces
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RF Base With Low Cost Interface
94
100
FLASH MEMORY
102
104
EEPROM
POWER

Fig. 4

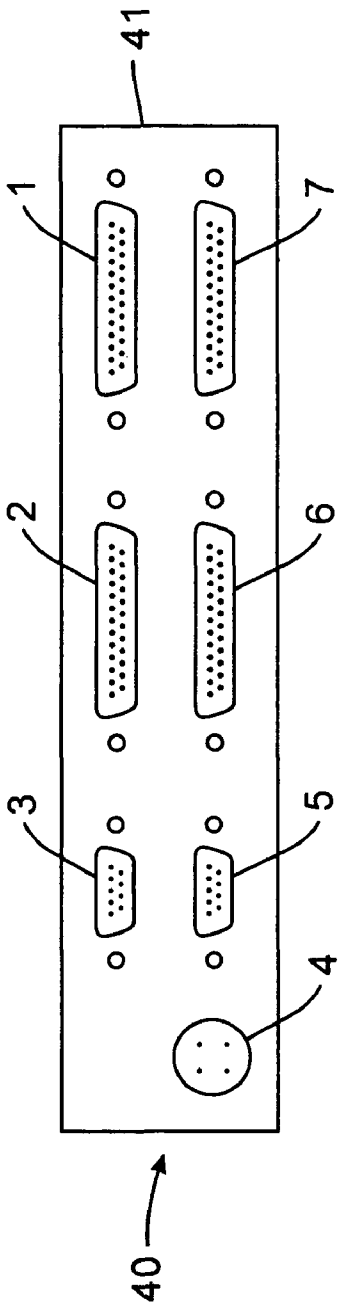
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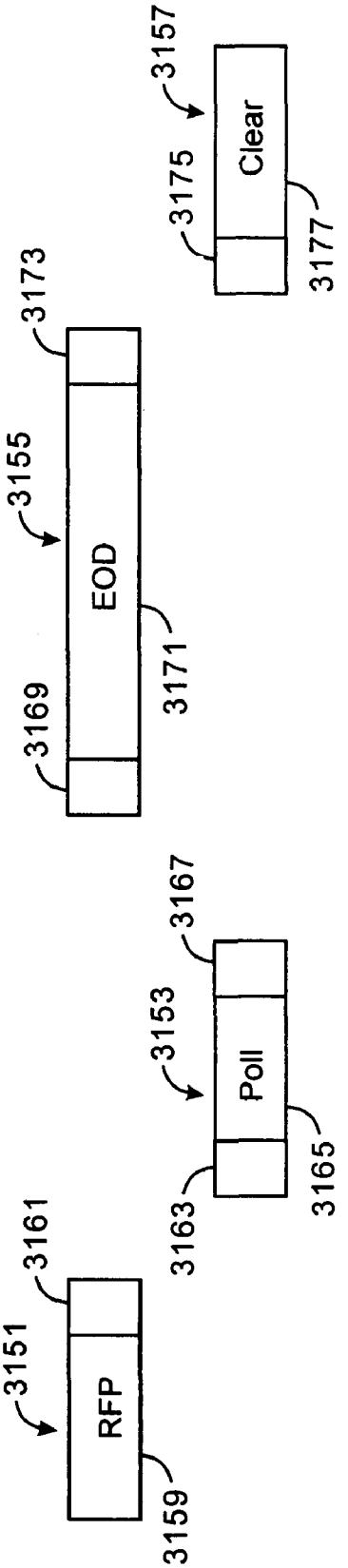
Fig. 5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Clear
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EOD
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Poll
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RFP
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Fig.20

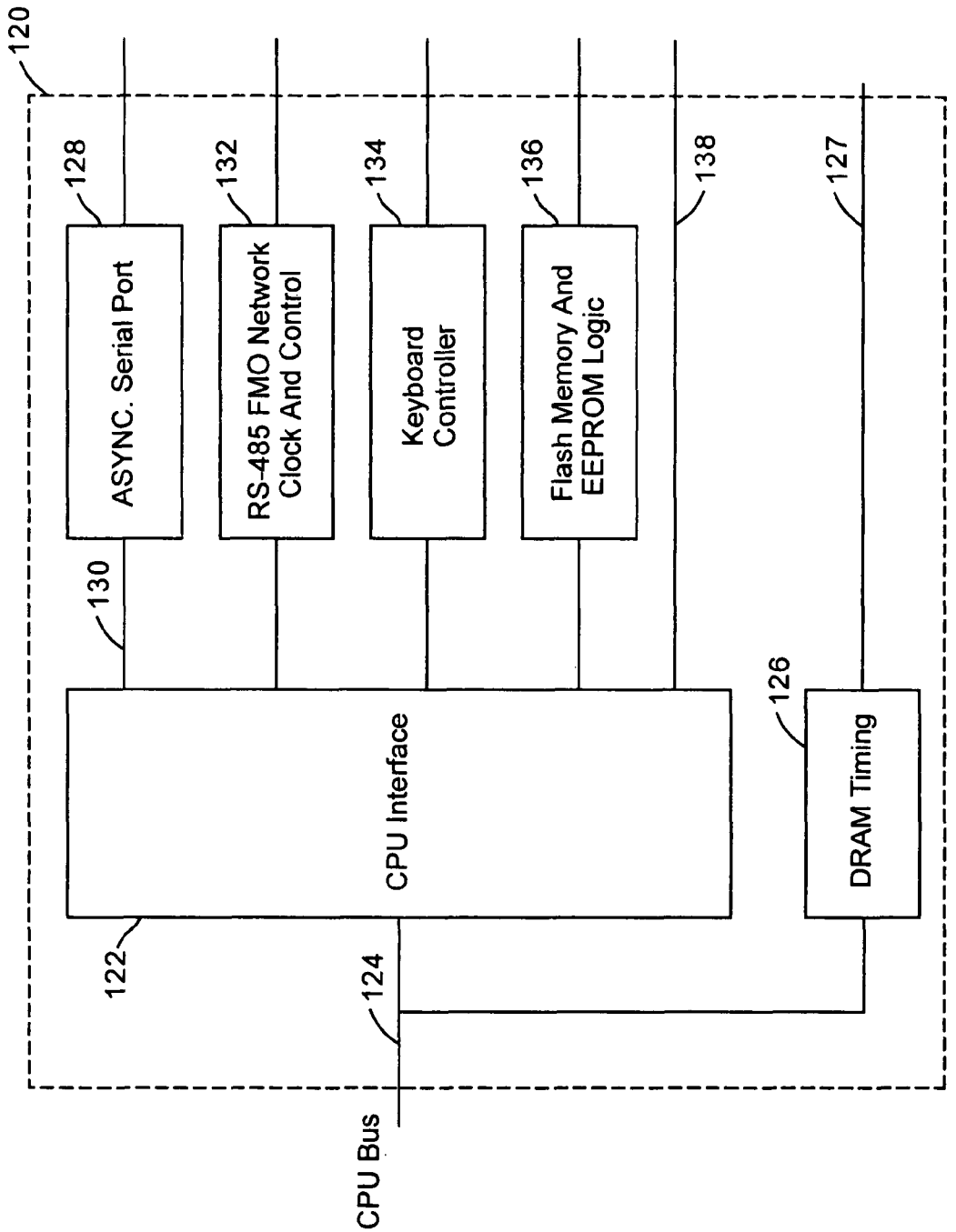

120
128
ASYNC. Serial Port
132
RS-485 FMO Network Clock And Control
134
Keyboard Controller
136
Flash Memory And EEPROM Logic
138
127
130
CPU Interface
126
DRAM Timing
122
124
CPU Bus

Fig.6

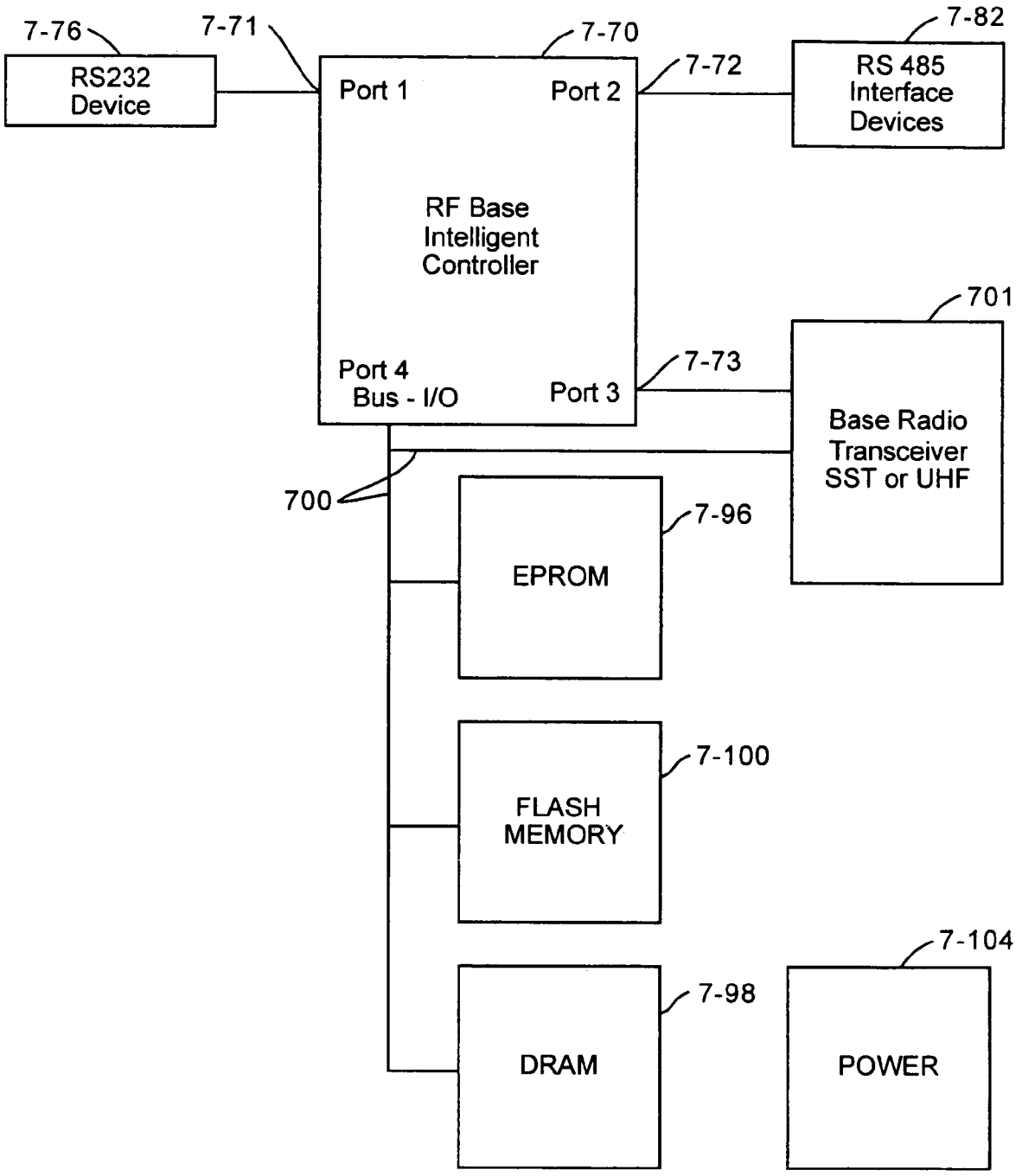

7-76
RS232 Device
7-71
7-70
Port 1
Port 2
7-72
7-82
RS 485 Interface Devices
RF Base Intelligent Controller
701
Port 4 Bus - I/O
Port 3
7-73
Base Radio Transceiver SST or UHF
700
EPROM
7-96
FLASH MEMORY
7-100
DRAM
7-98
POWER
7-104

Fig. 7

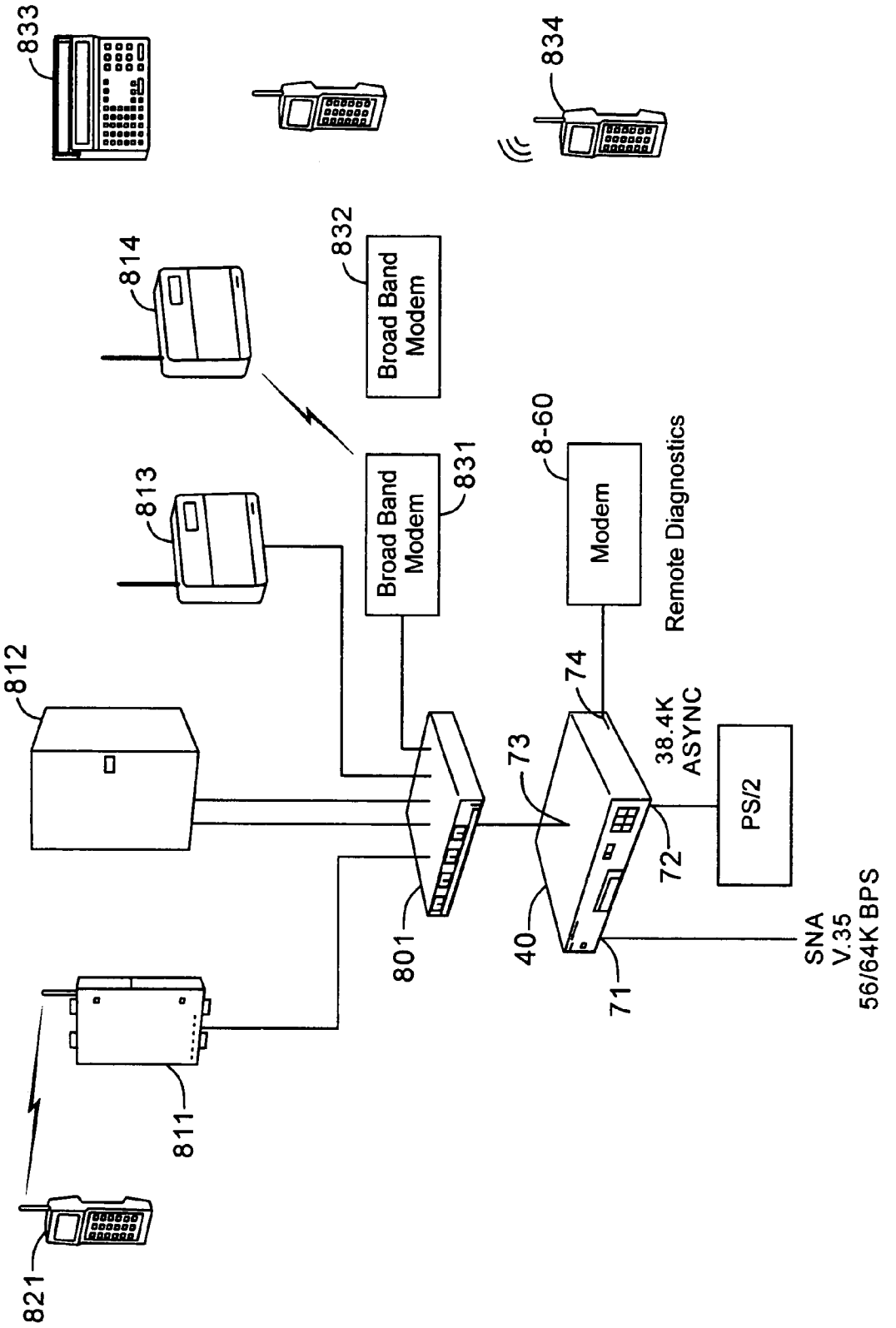

833
834
814
832
Broad Band Modem
813
831
Broad Band Modem
8-60
Modem
Remote Diagnostics
812
74
38.4K ASYNC
73
PS/2
72
801
40
71
SNA V.35 56/64K BPS
811
821

Fig.8

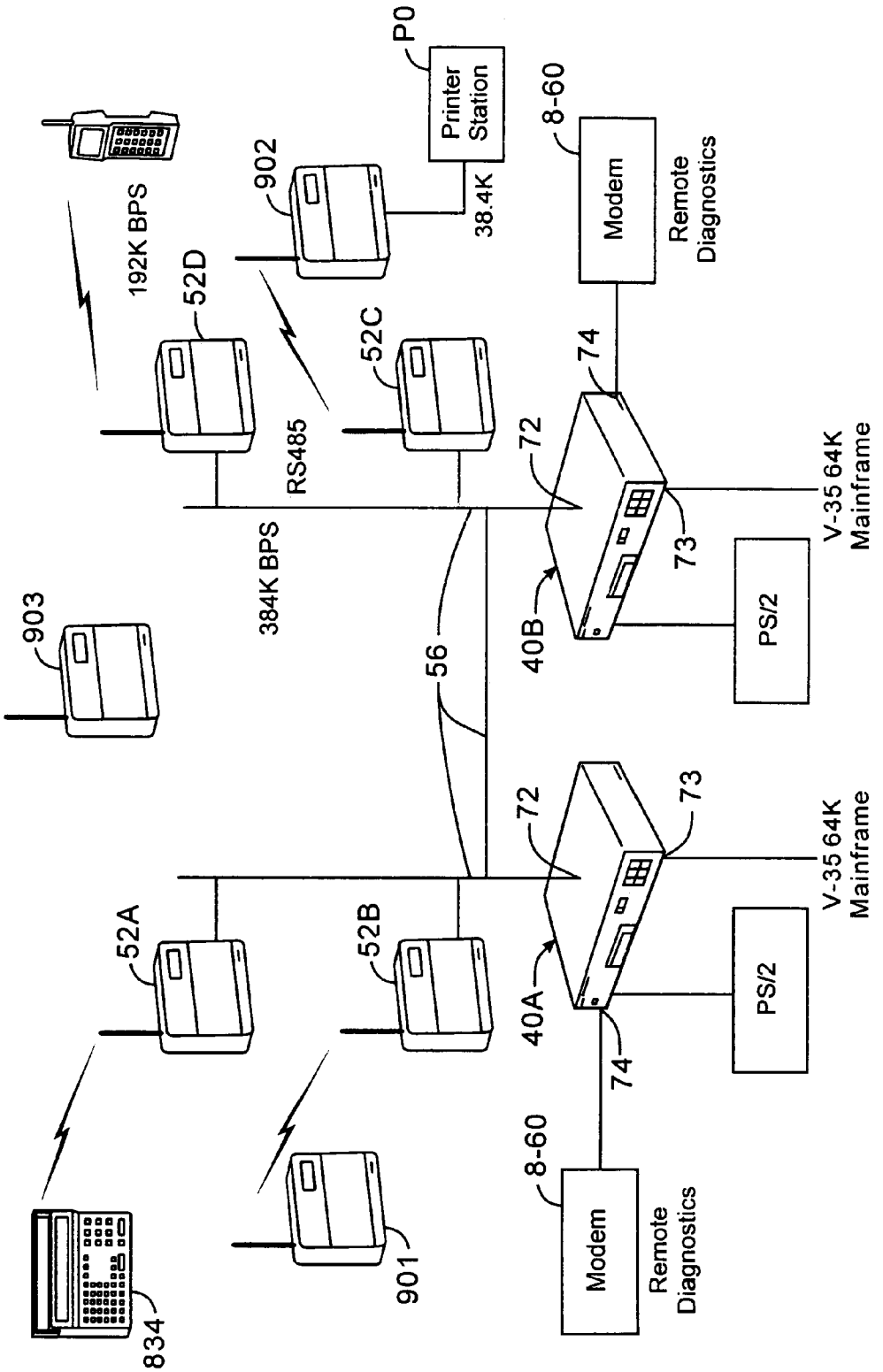

P0
Printer Station
38.4K
902
8-60
Modem
Remote Diagnostics
192K BPS
52D
52C
74
RS485
72
V-35 64K Mainframe
384K BPS
73
903
56
40B
PS/2
72
73
V-35 64K Mainframe
52A
52B
40A
PS/2
74
8-60
Modem
Remote Diagnostics
901
834

Fig.9

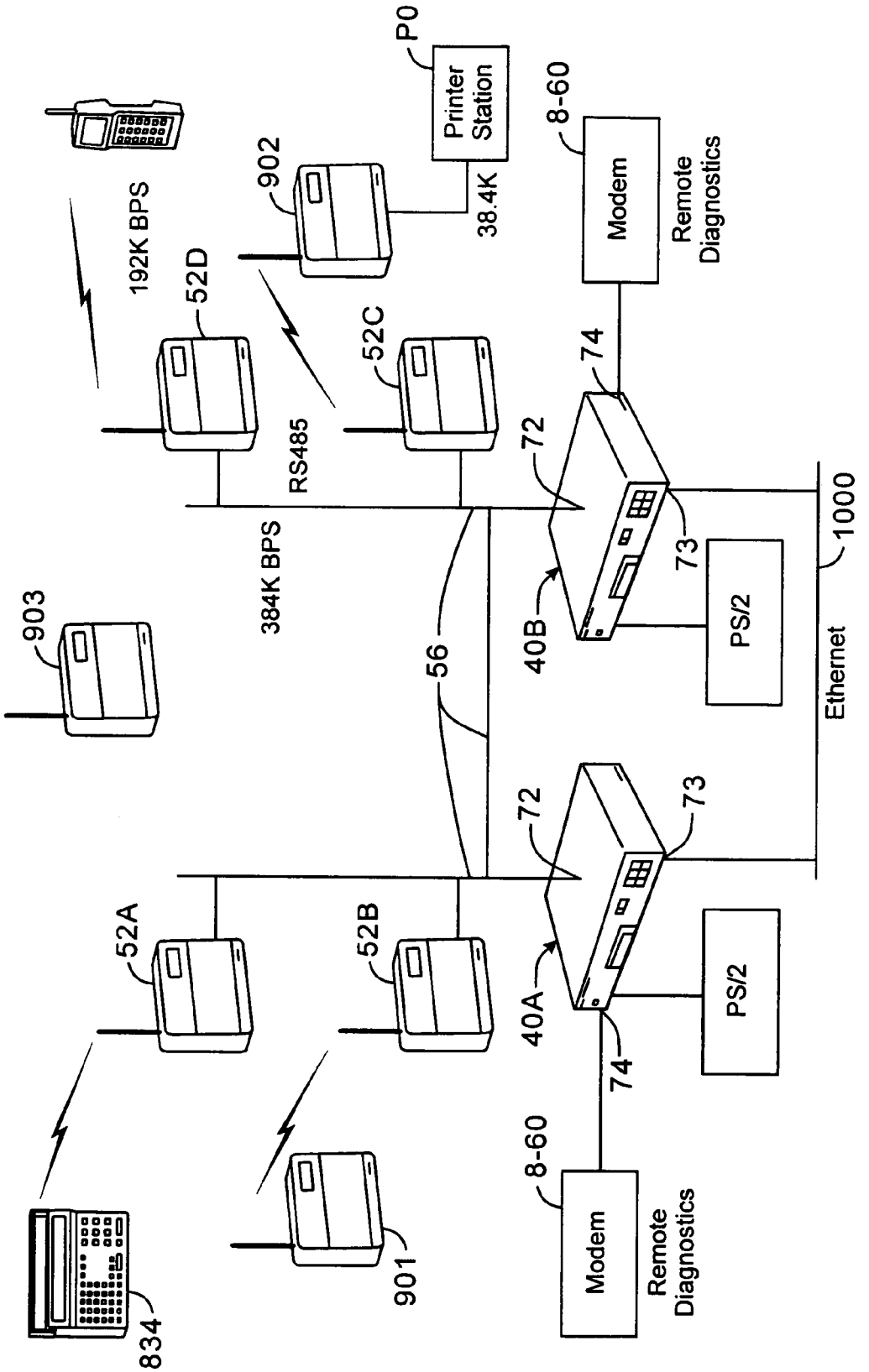

P0
Printer Station
38.4K
902
8-60
Modem
Remote Diagnostics
192K BPS
52D
52C
74
RS485
72
384K BPS
903
56
40B
73
PS/2
1000
Ethernet
52A
52B
40A
74
8-60
Modem
Remote Diagnostics
901
834

Fig.10

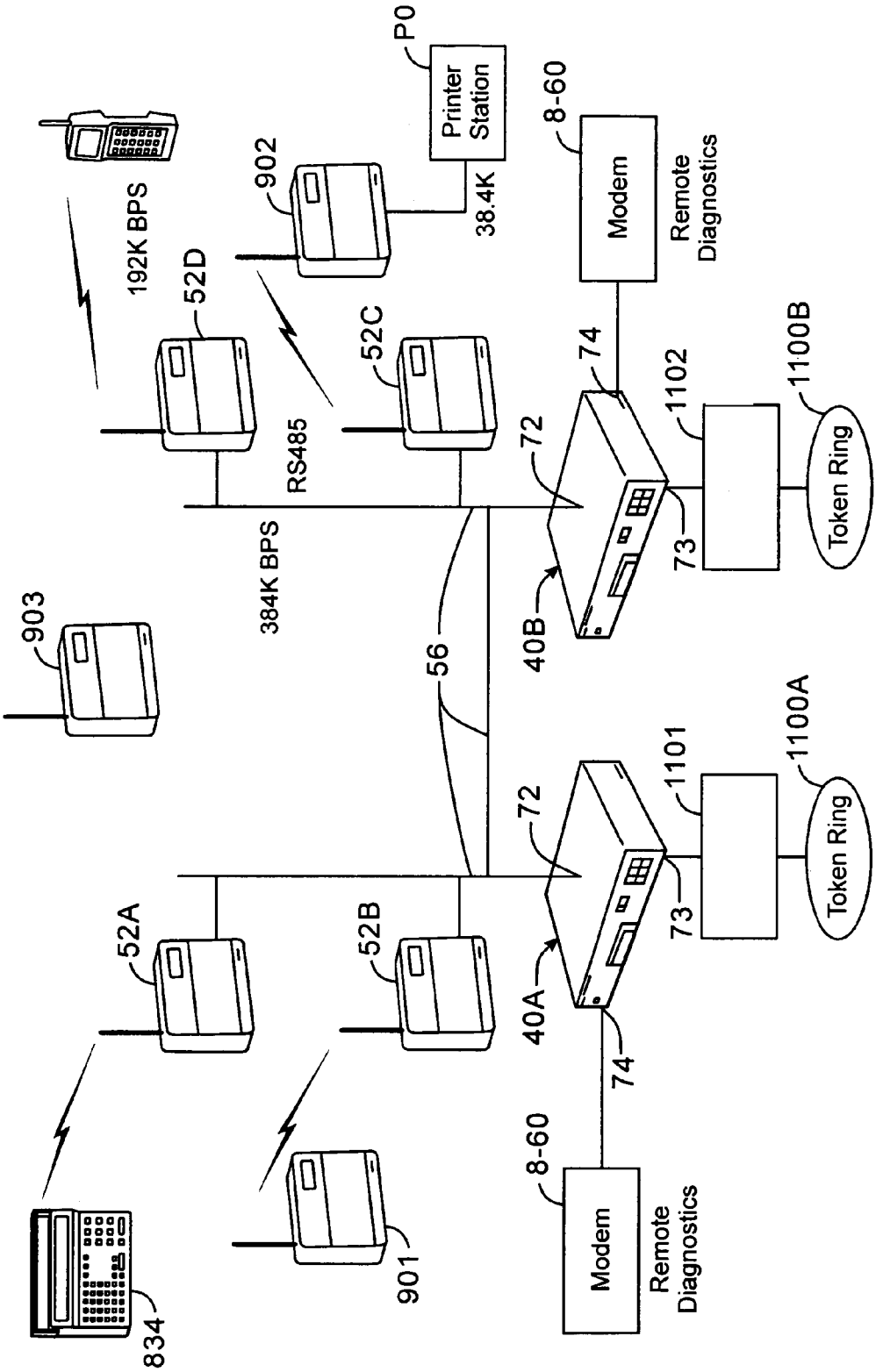

P0
Printer Station
38.4K
902
8-60
Modem
Remote Diagnostics
192K BPS
52D
52C
74
1102
1100B
Token Ring
RS485
72
384K BPS
903
56
40B
73
1101
1100A
52A
52B
40A
74
8-60
Modem
Remote Diagnostics
901
834

Fig.11

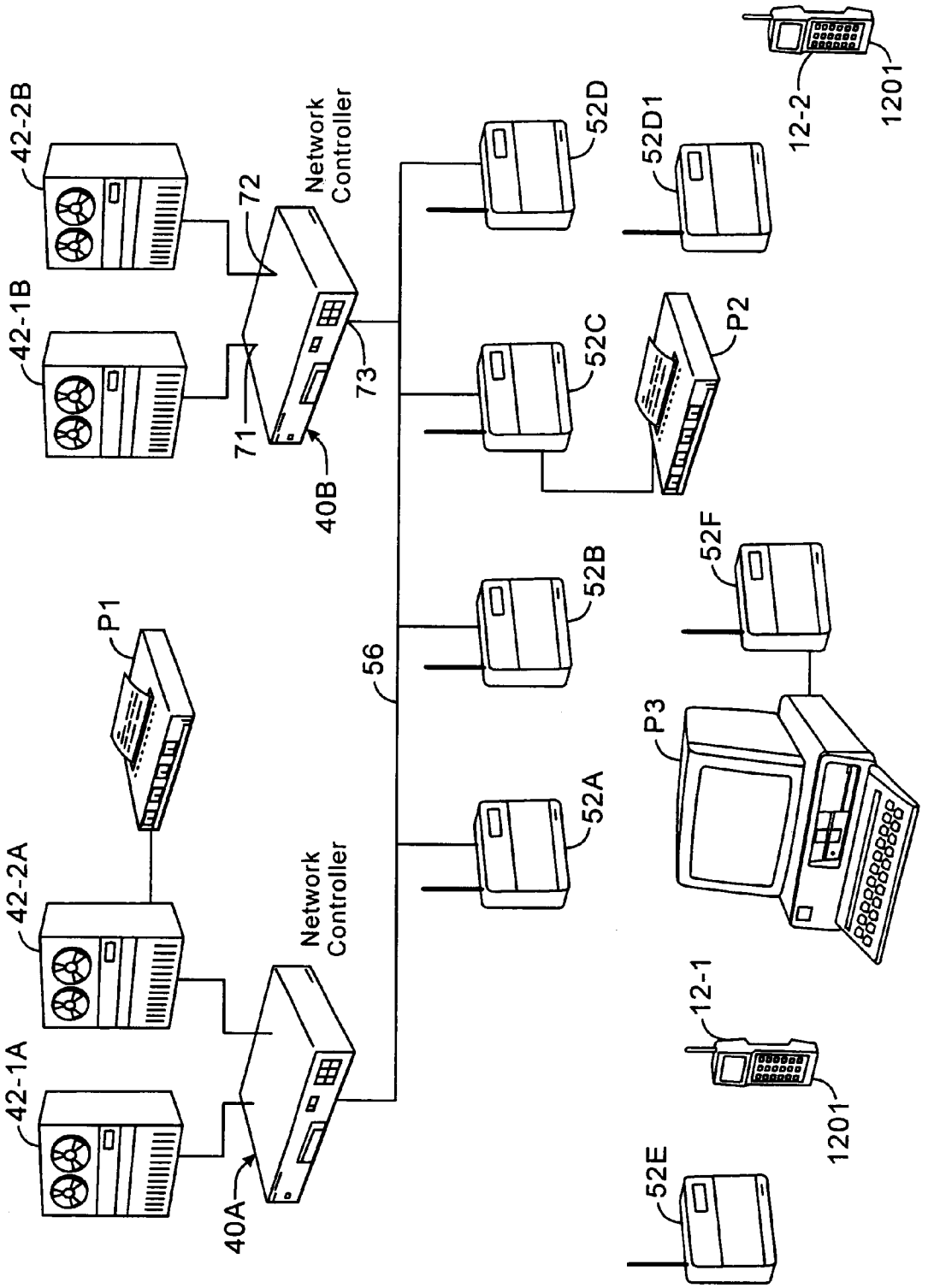

42-2B
42-1B
72
Network Controller
71
73
40B
52D
52D1
12-2
1201
52C
P2
52B
52F
56
P1
P3
52A
42-2A
42-1A
Network Controller
12-1
1201
40A
52E

Fig.12

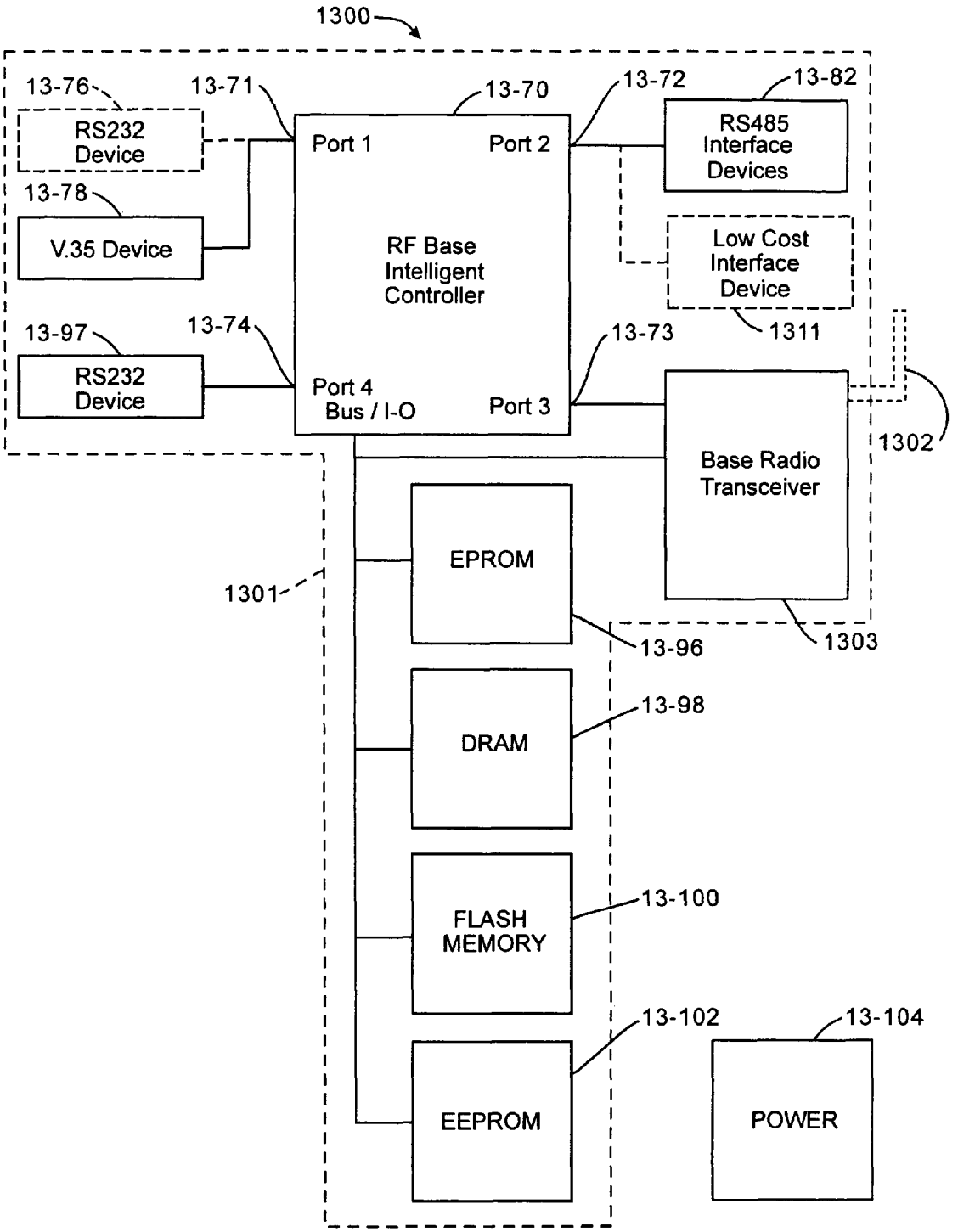

1300
13-76
13-71
13-70
13-72
13-82
RS232 Device
Port 1
Port 2
RS485 Interface Devices
13-78
V.35 Device
RF Base Intelligent Controller
Low Cost Interface Device
1311
13-97
13-74
13-73
RS232 Device
Port 4 Bus / I-O
Port 3
1302
Base Radio Transceiver
EPROM
1301
13-96
1303
13-98
DRAM
FLASH MEMORY
13-100
13-102
13-104
EEPROM
POWER

Fig. 13

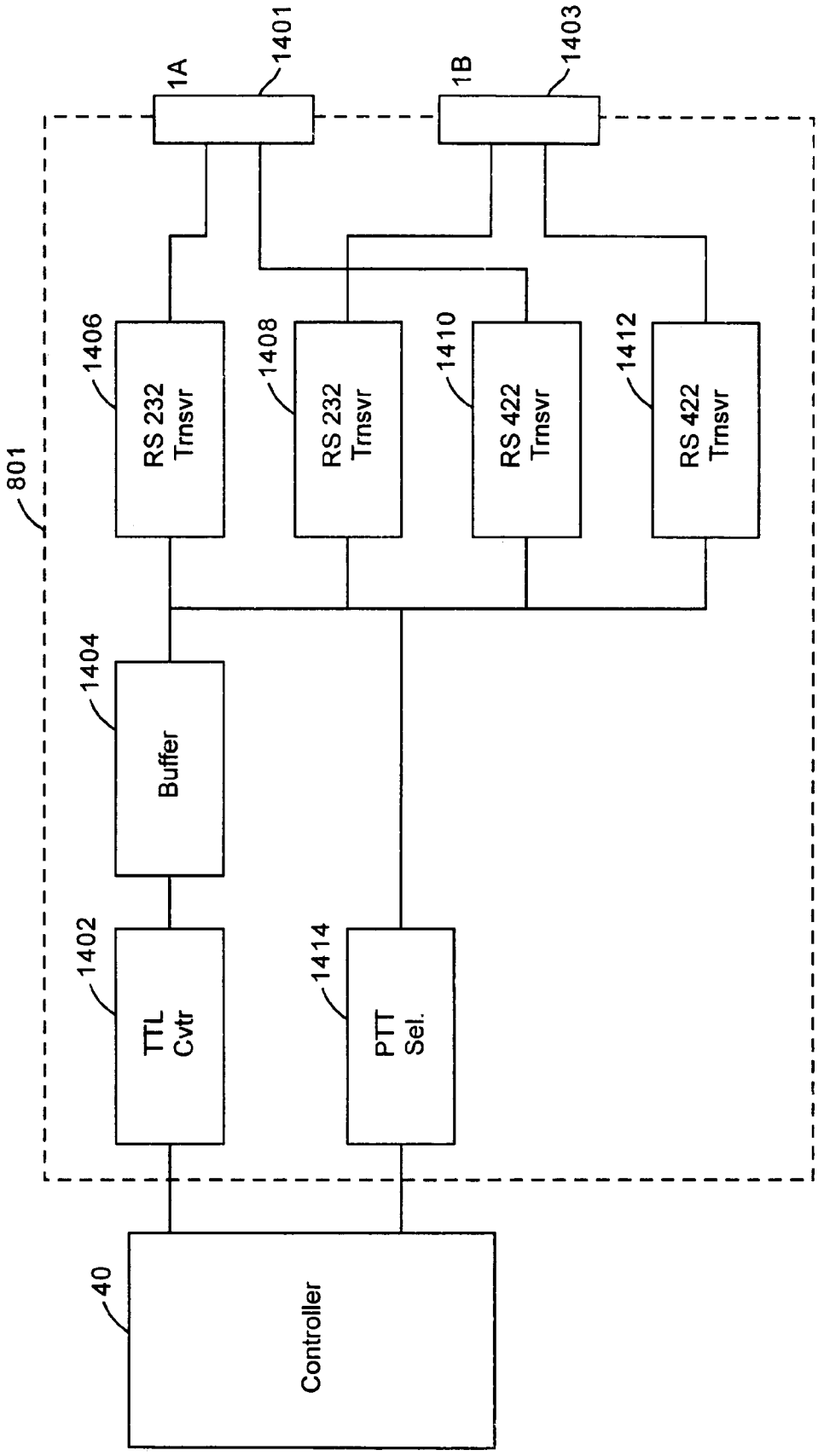

1A
1401
1B
1403
801
1406
RS 232 Trnsvr
1408
RS 232 Trnsvr
1410
RS 422 Trnsvr
1412
RS 422 Trnsvr
1404
Buffer
1402
TTL Cvtr
1414
PTT Sel.
40
Controller

Fig.14

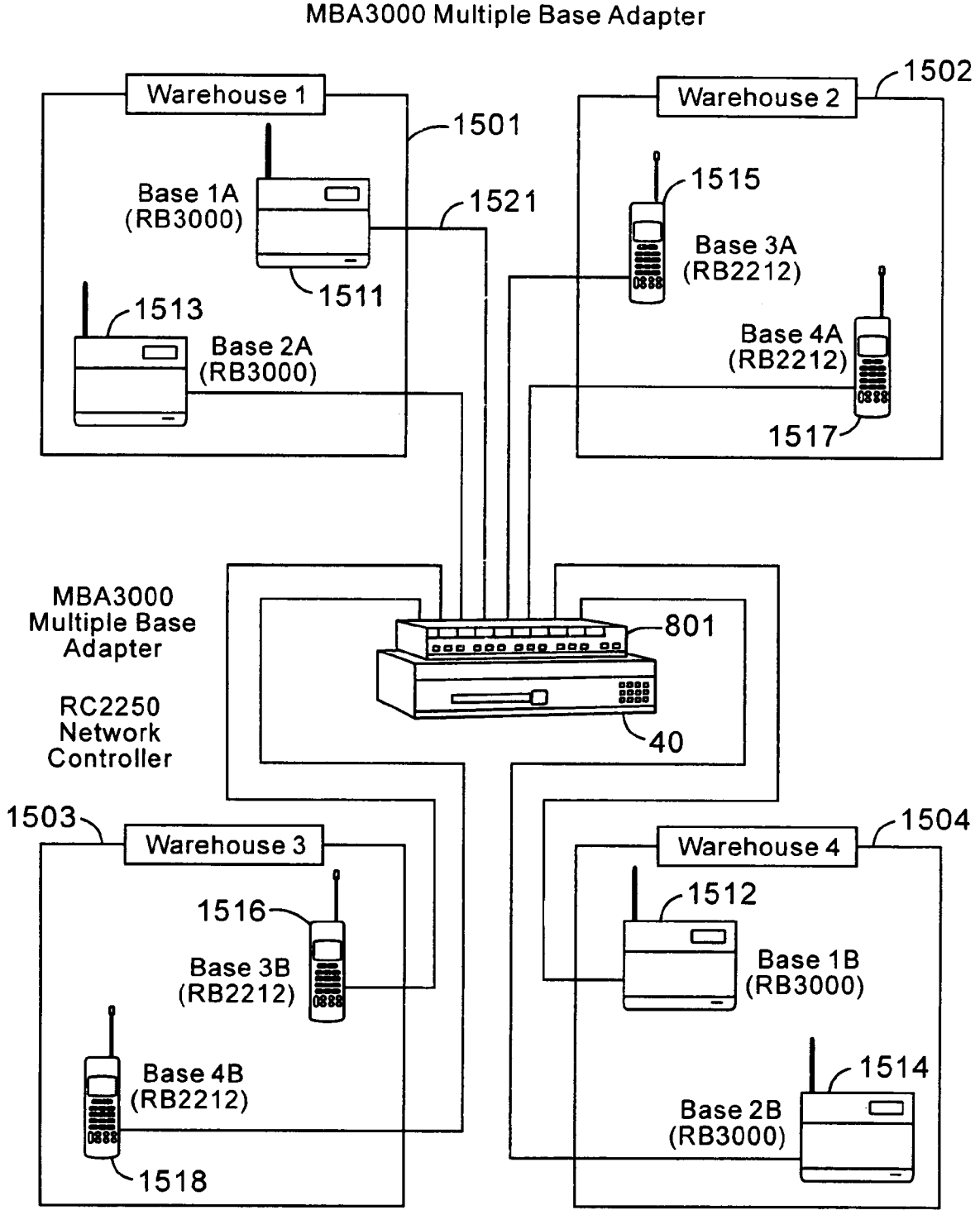

MBA3000 Multiple Base Adapter
Warehouse 1
1501
Base 1A
(RB3000)
1521
1511
1513
Base 2A
(RB3000)
Warehouse 2
1502
1515
Base 3A
(RB2212)
Base 4A
(RB2212)
1517
MBA3000
Multiple Base
Adapter
RC2250
Network
Controller
801
40
1503
Warehouse 3
1516
Base 3B
(RB2212)
Base 4B
(RB2212)
1518
Warehouse 4
1504
1512
Base 1B
(RB3000)
1514
Base 2B
(RB3000)

Fig. 15

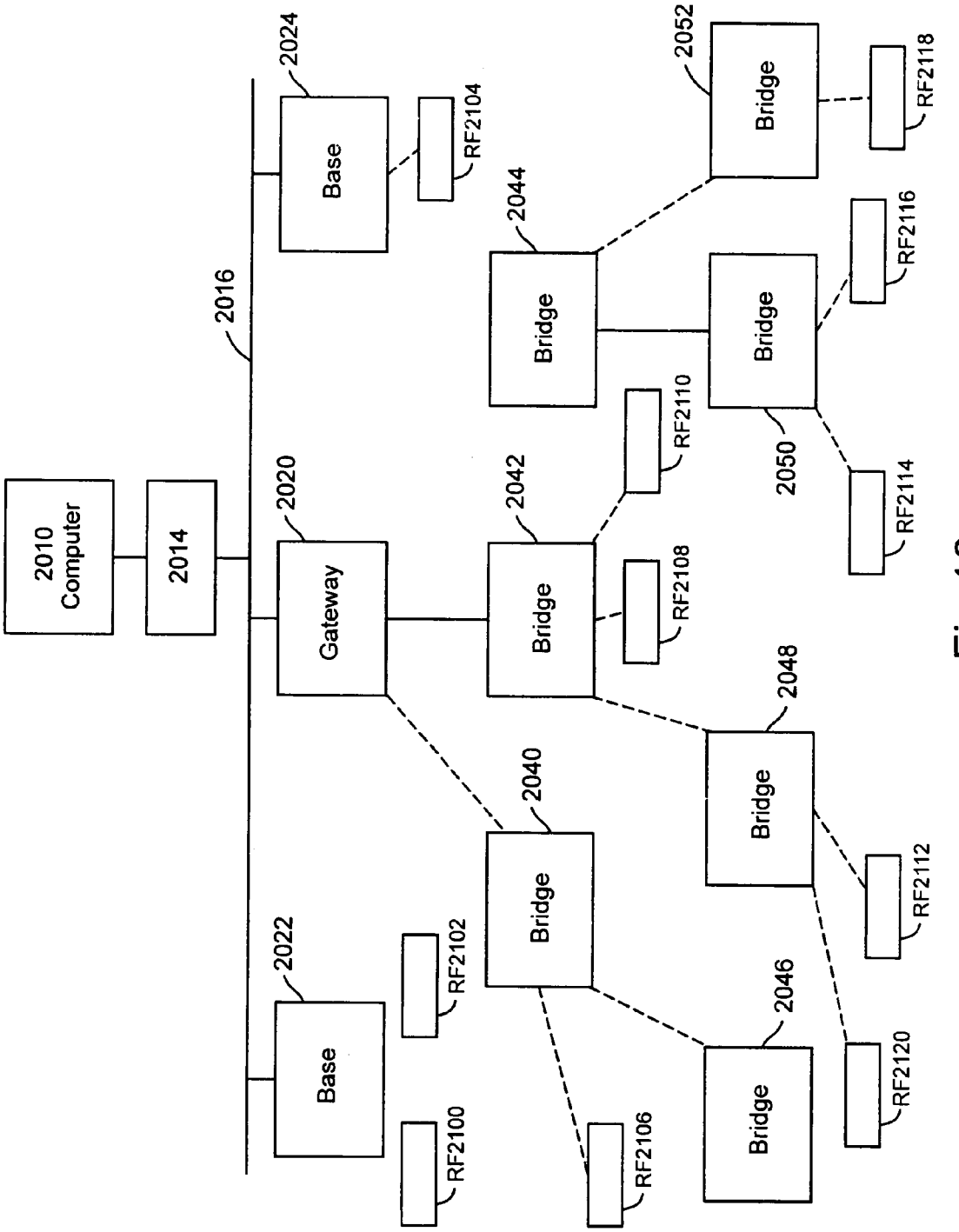

2010
Computer
2014
2016
2020
Gateway
2022
Base
RF2100
RF2102
2024
Base
RF2104
2040
Bridge
RF2106
2042
Bridge
RF2108
RF2110
2044
Bridge
2046
Bridge
2048
Bridge
RF2112
2050
Bridge
RF2114
RF2116
2052
Bridge
RF2118
RF2120

Fig.16

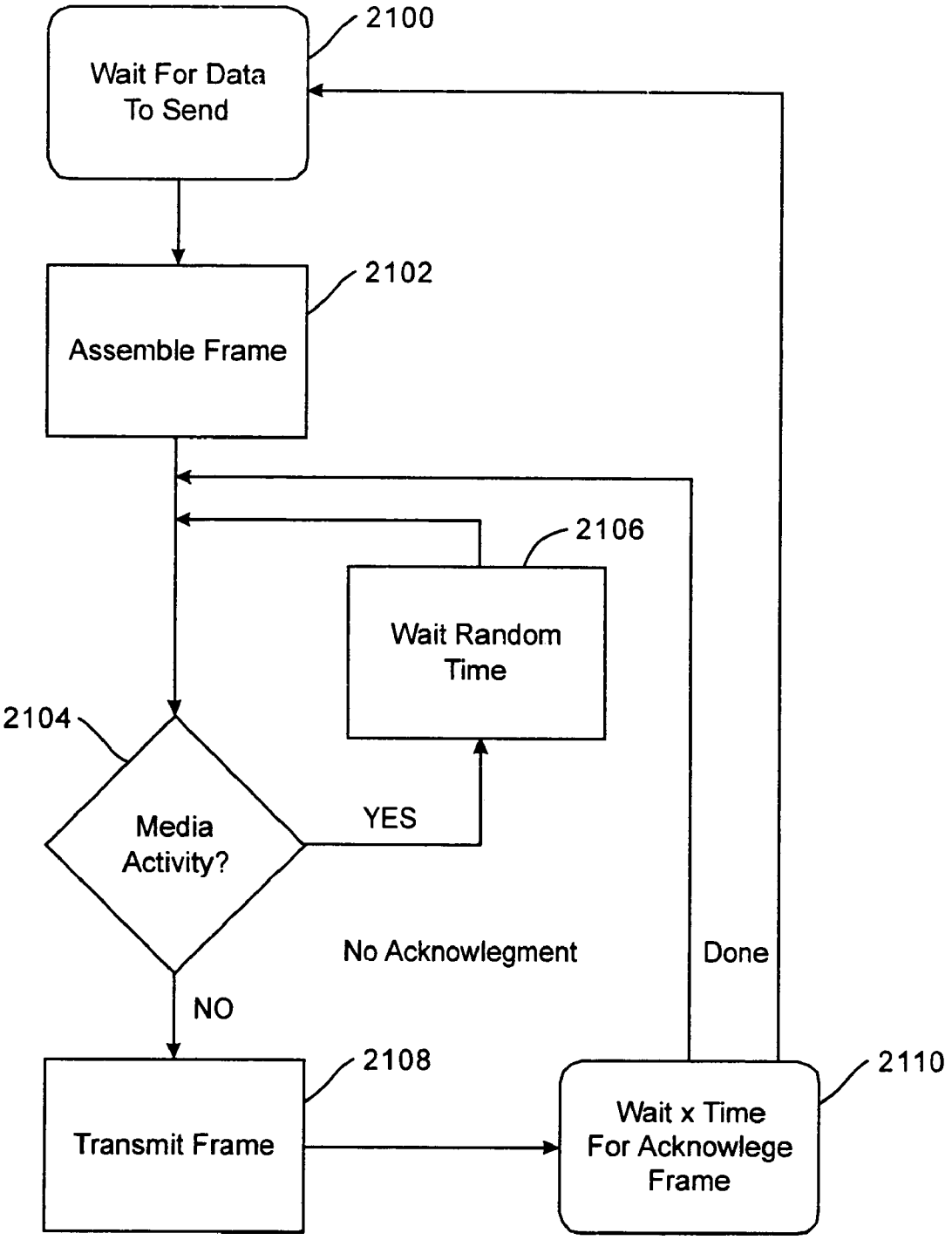

2100
Wait For Data To Send
2102
Assemble Frame
2106
Wait Random Time
2104
Media Activity?
YES
No Acknowlegment
Done
NO
2108
Transmit Frame
2110
Wait x Time For Acknowlege Frame

Fig. 17

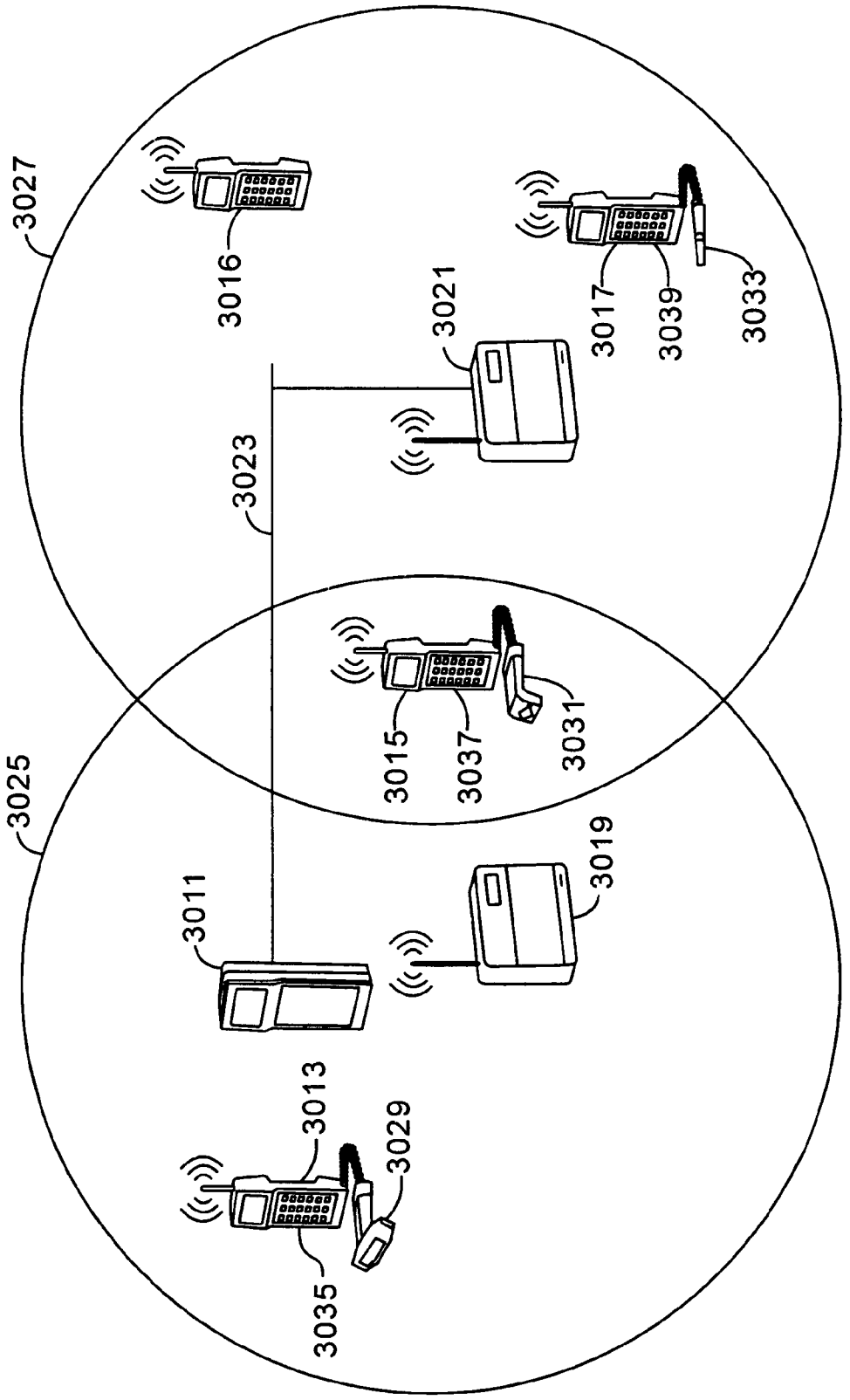

3027
3016
3021
3017
3039
3033
3023
3015
3037
3031
3025
3019
3011
3013
3029
3035

Fig.18

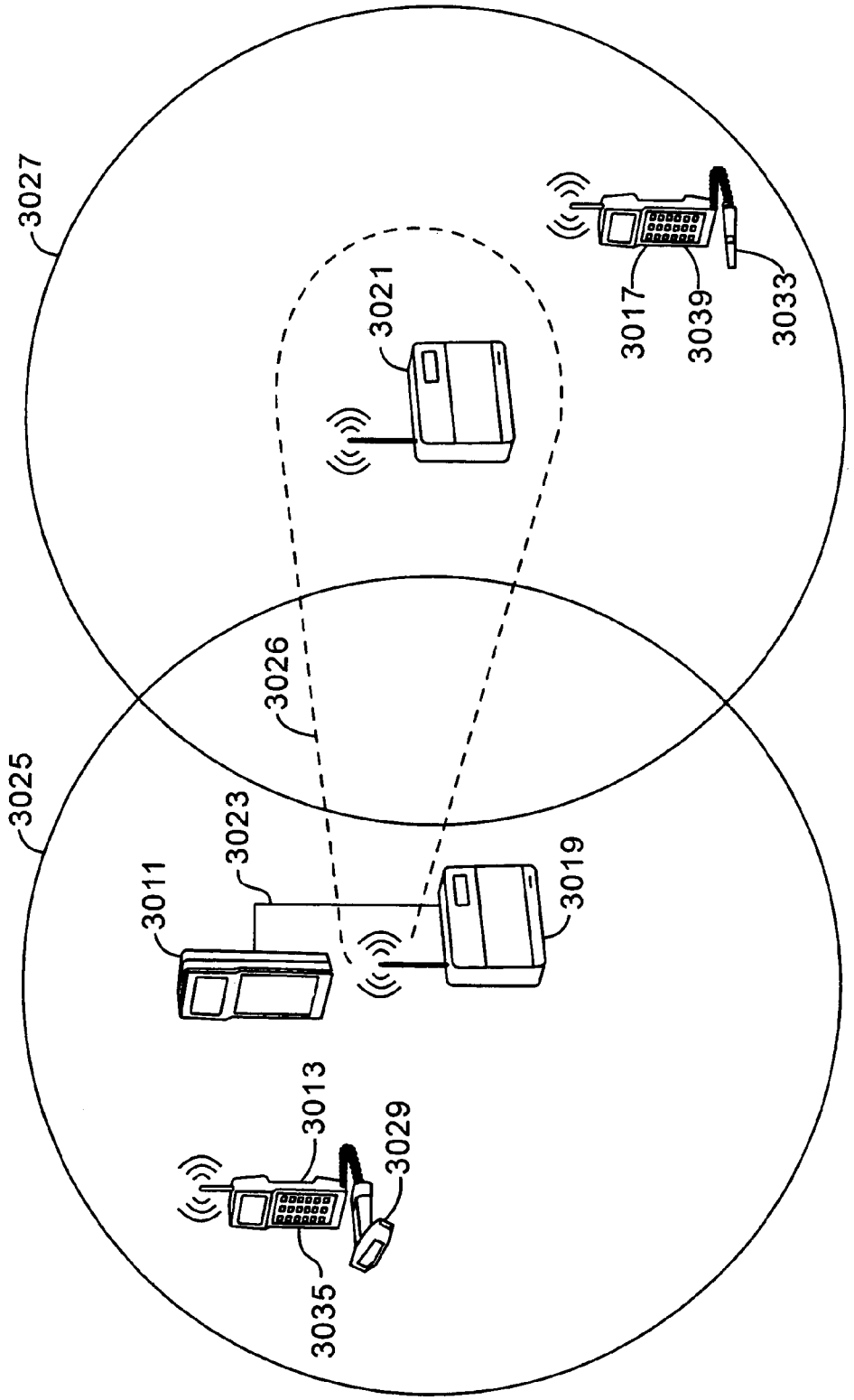

3027
3021
3017
3039
3033
3026
3025
3023
3011
3019
3013
3029
3035

Fig.18A

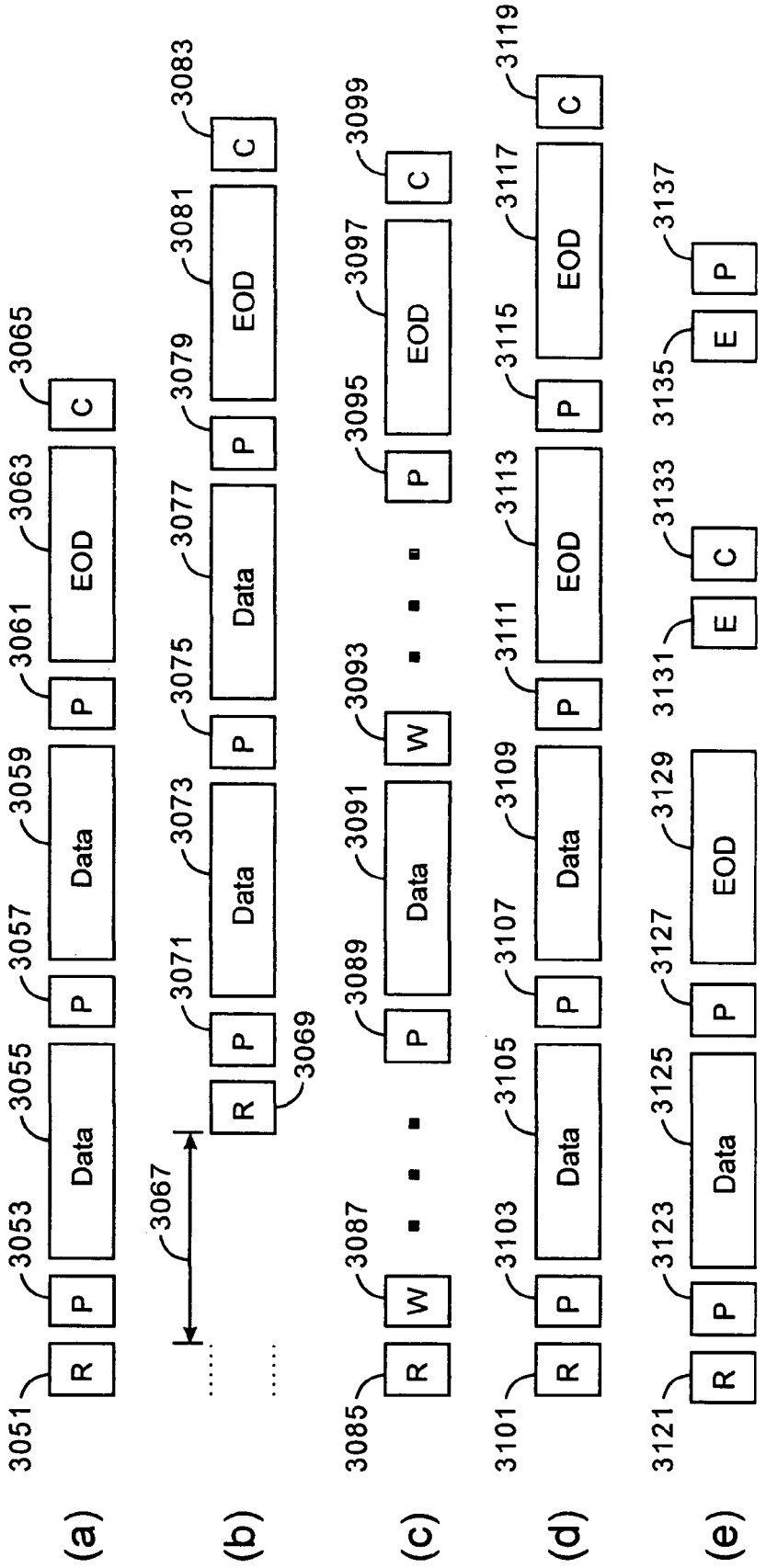

(a)
3051
R
3053
P
3055
Data
3057
P
3059
Data
3061
P
3063
EOD
3065
C
(b)
3067
3069
R
3071
P
3073
Data
3075
P
3077
Data
3079
P
3081
EOD
3083
C
(c)
3085
R
3087
W
3089
P
3091
Data
3093
W
3095
P
3097
EOD
3099
C
(d)
3101
R
3103
P
3105
Data
3107
P
3109
Data
3111
P
3113
EOD
3115
P
3117
EOD
3119
C
(e)
3121
R
3123
P
3125
Data
3127
P
3129
EOD
3131
E
3133
C
3135
E
3137
P

Fig.19

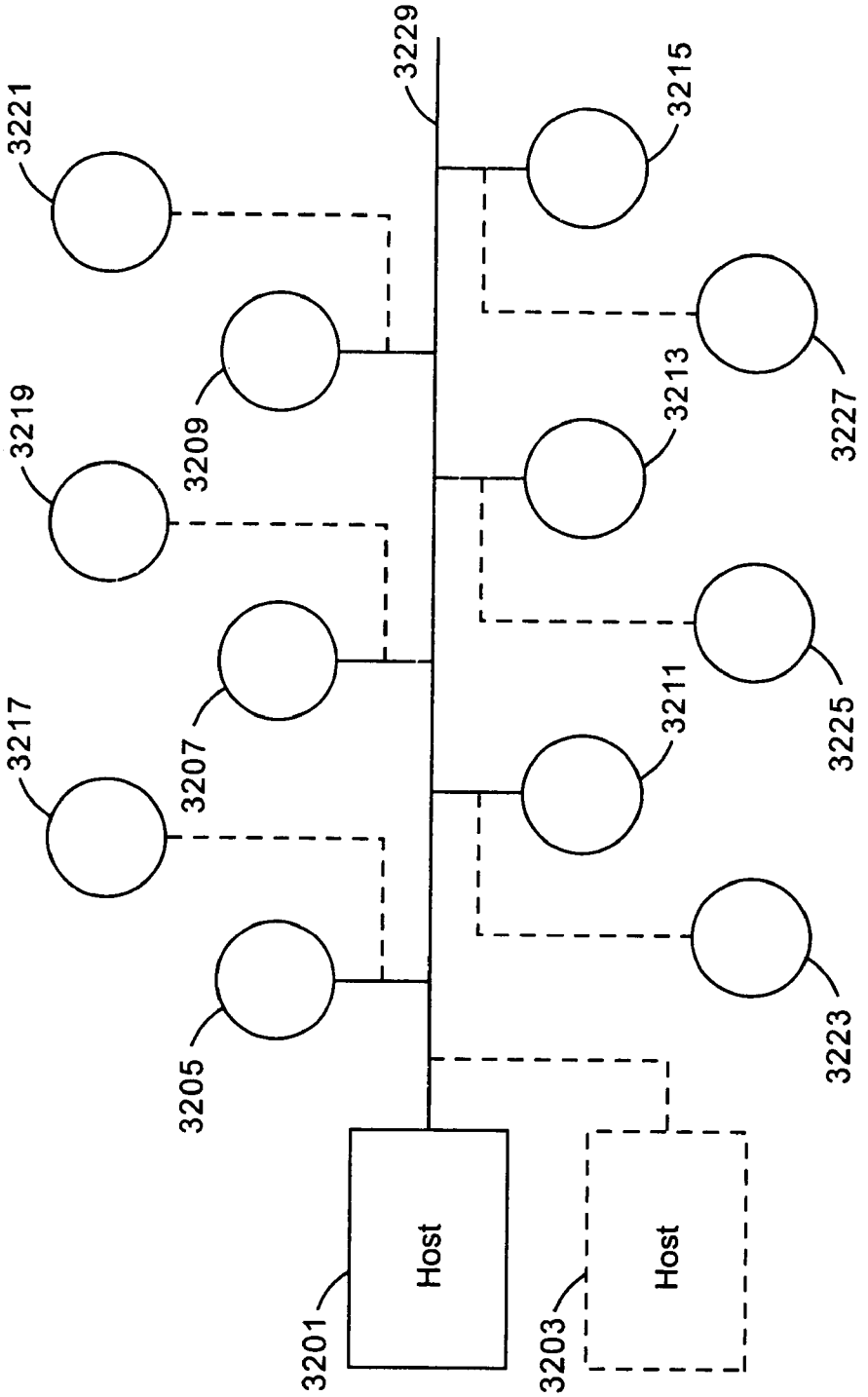

3229
3215
3221
3213
3209
3227
3219
3211
3207
3225
3217
3223
3205
Host
3201
Host
3203

Fig.21

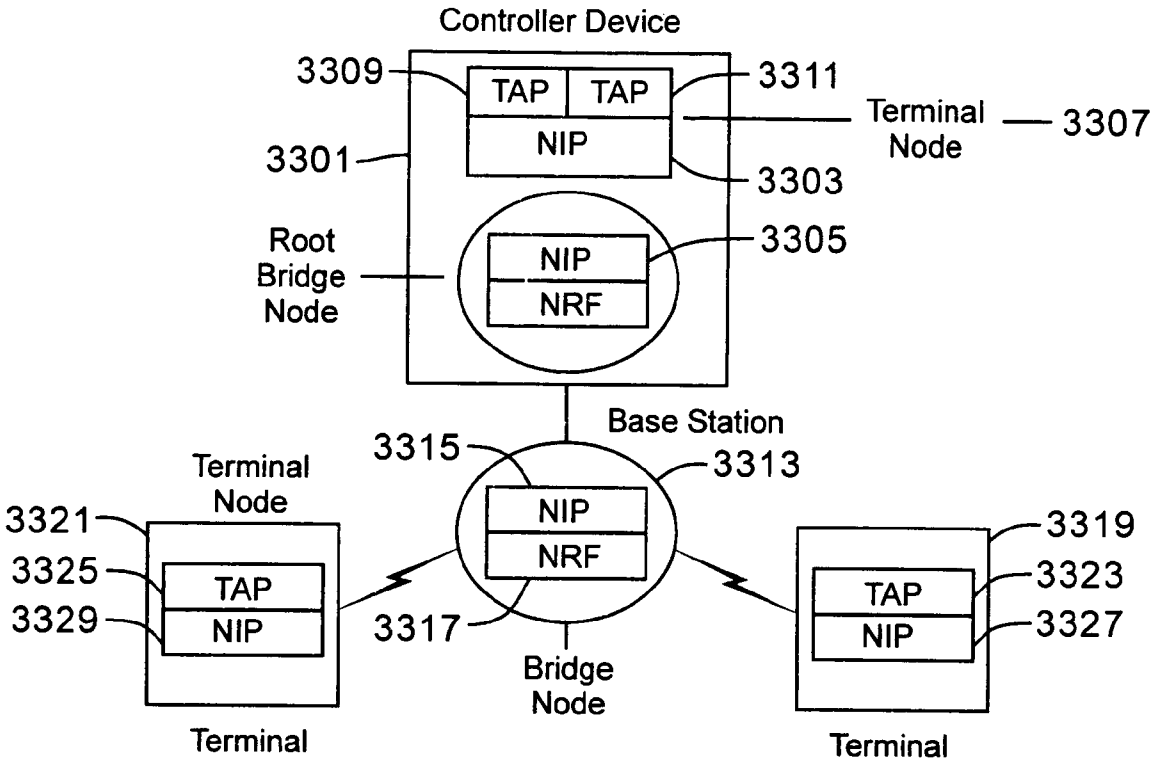

Controller Device
3309
TAP
TAP
3311
Terminal Node
3307
NIP
3301
3303
Root Bridge Node
NIP
NRF
3305
Base Station
3315
3313
Terminal Node
NIP
NRF
3321
3325
3329
TAP
NIP
3317
3319
3323
3327
TAP
NIP
Bridge Node
Terminal
Terminal

Fig. 22

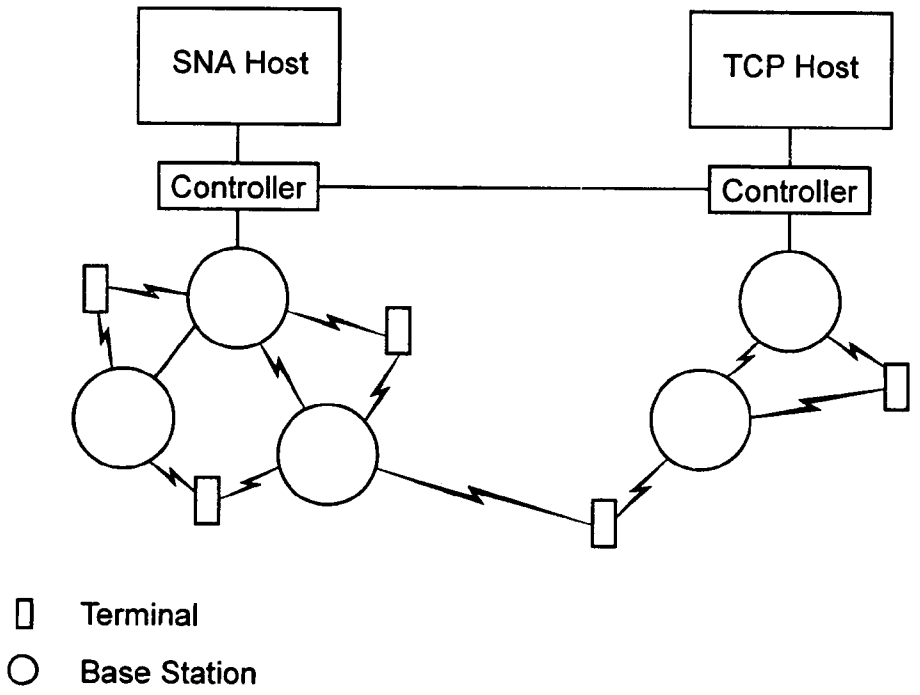

SNA Host
TCP Host
Controller
Controller
Terminal
Base Station

Fig. 23

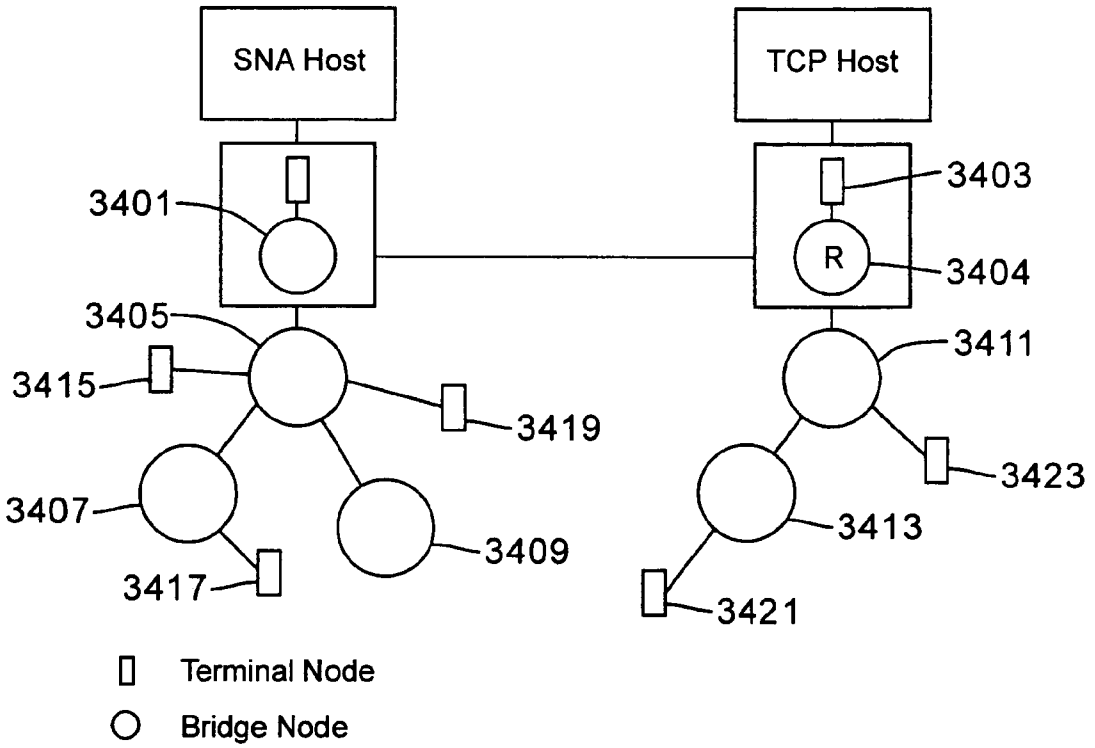

SNA Host
TCP Host
3401
3403
R
3404
3405
3411
3415
3419
3423
3407
3413
3409
3417
3421
Terminal Node
Bridge Node

Fig. 24

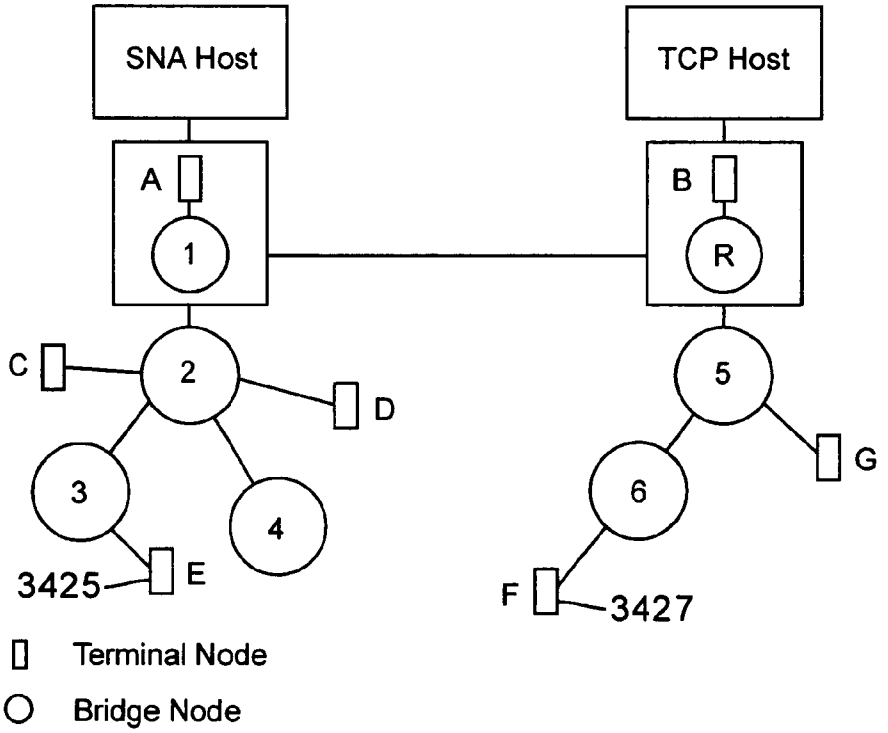

SNA Host
TCP Host
A
B
1
R
C
2
5
D
G
3
6
4
3425
E
F
3427
Terminal Node
Bridge Node

Fig. 25

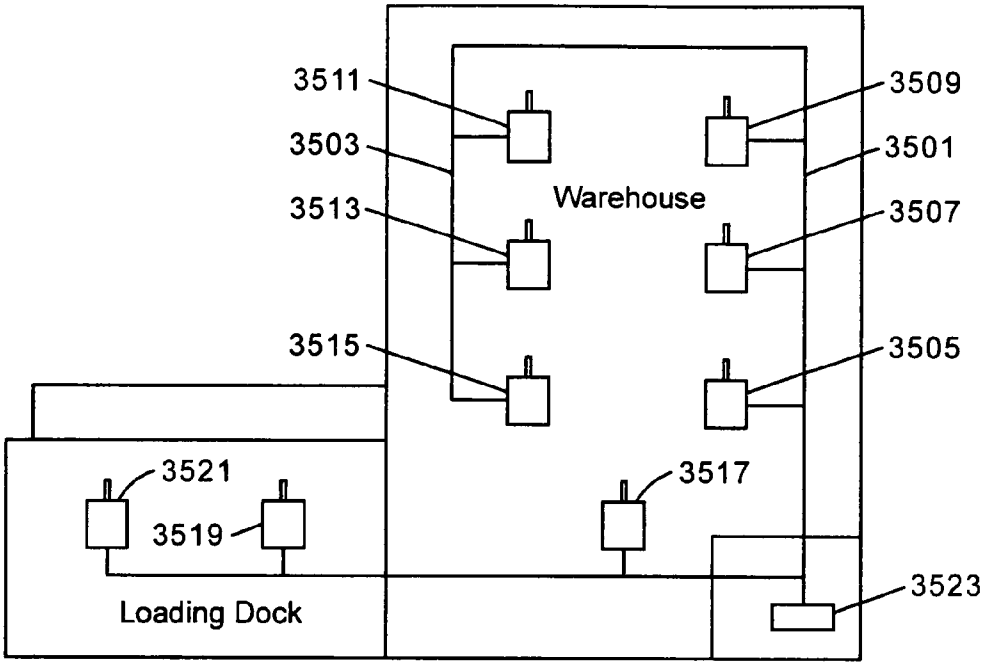

3511
3509
3503
3501
Warehouse
3513
3507
3515
3505
3521
3517
3519
3523
Loading Dock

Fig. 26

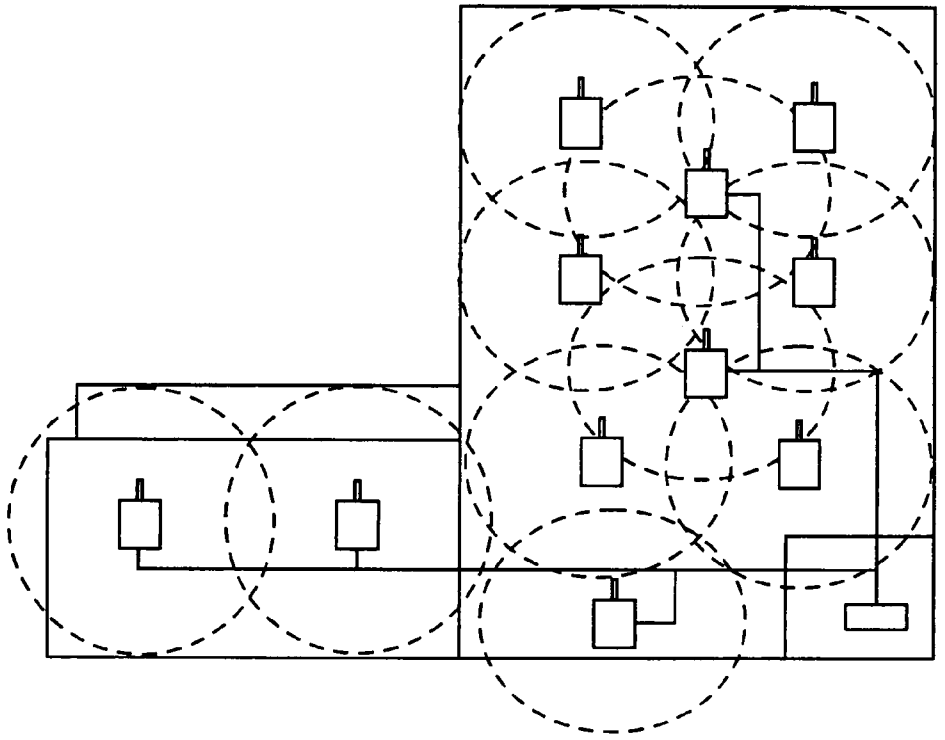


Fig. 27

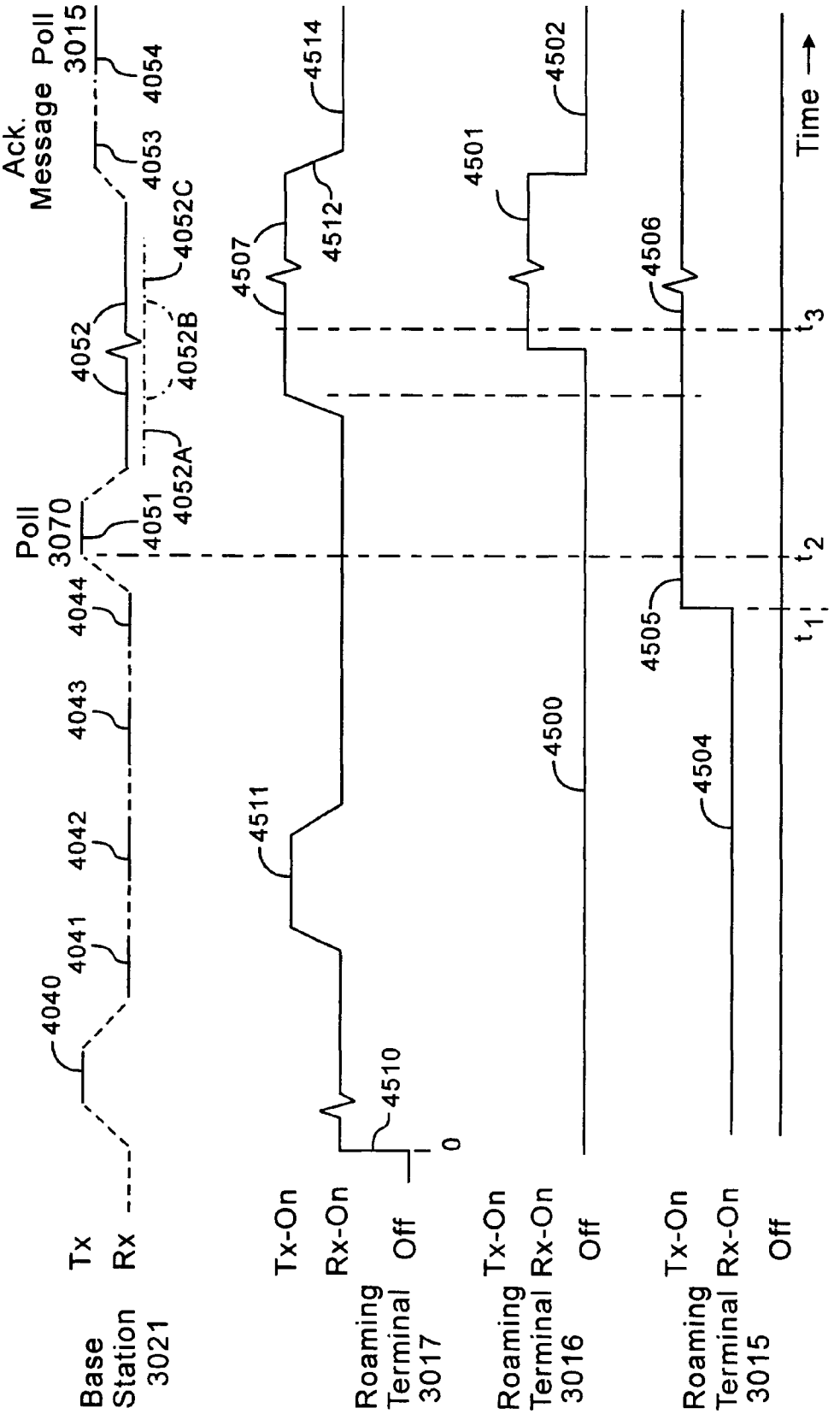
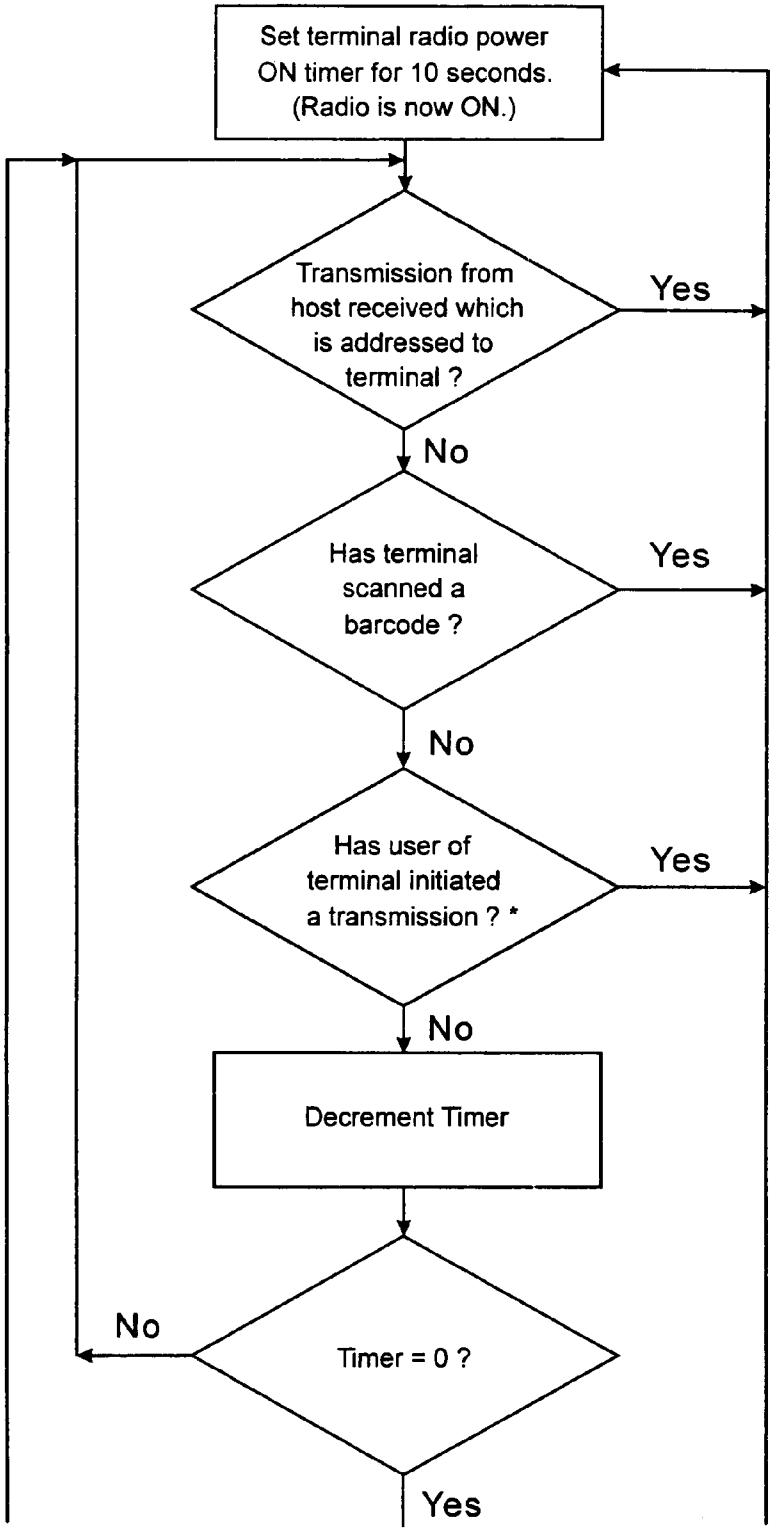

Base Station 3021
Tx
Rx
Roaming Terminal 3017
Tx-On
Rx-On
Off
Roaming Terminal 3016
Tx-On
Rx-On
Off
Roaming Terminal 3015
Tx-On
Rx-On
Off
Poll 3070
Ack. Message Poll 3015
4040
4041
4042
4043
4044
4051
4052
4052A
4052B
4052C
4053
4054
4500
4501
4502
4504
4505
4506
4507
4510
4511
4512
4514
0
t_1
t_2
t_3
Time

Fig.28



* The user of the terminal initiates a transmission by pressing the 'ENTER' or, depending on the specific software version, any of the function keys. Pressing these keys causes the terminal to power up the radio and send any data entered by the user.

Fig.29

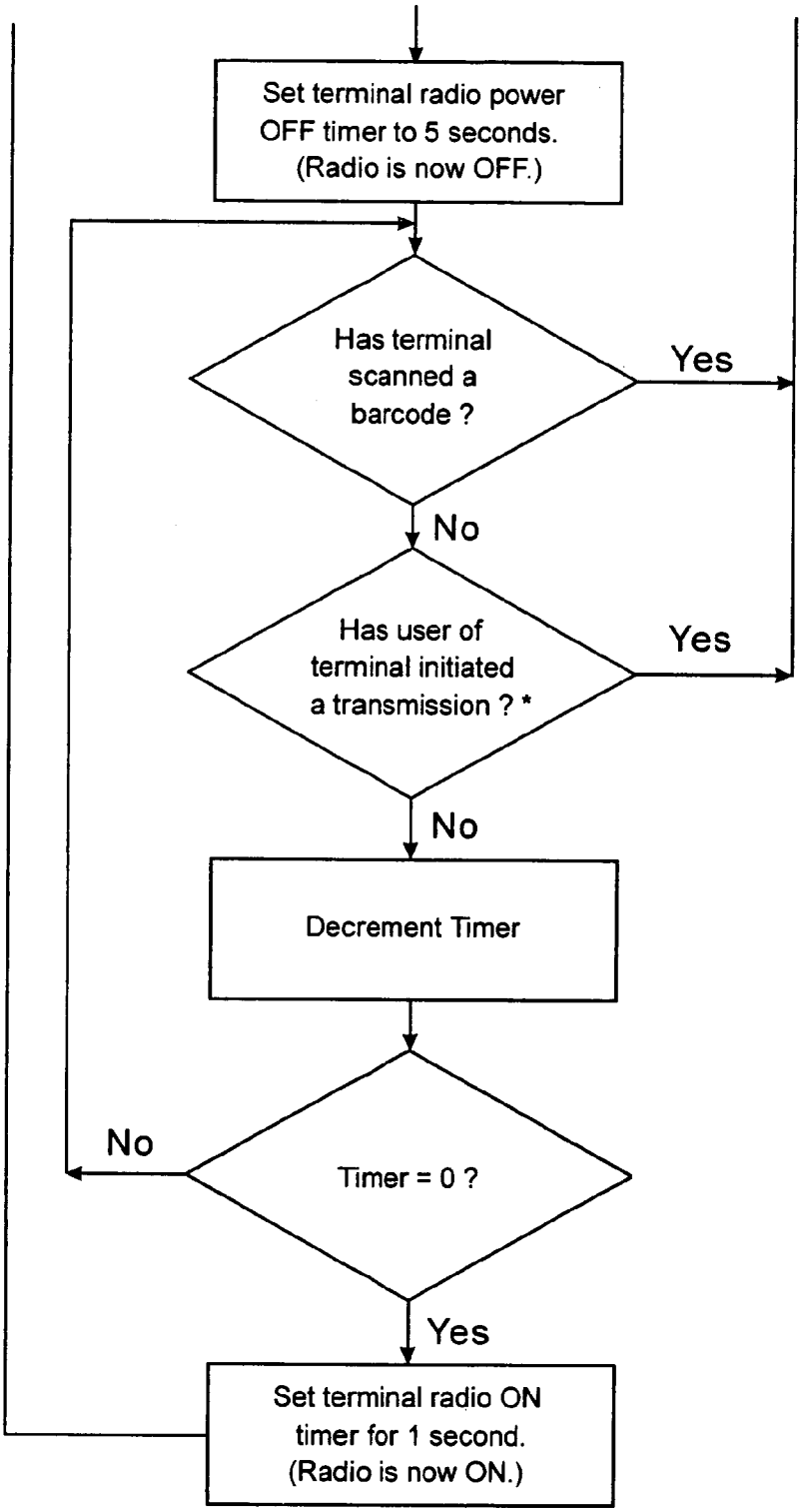

Set terminal radio power OFF timer to 5 seconds. (Radio is now OFF.)
Has terminal scanned a barcode ?
Yes
No
Has user of terminal initiated a transmission ? *
Yes
No
Decrement Timer
Timer = 0 ?
No
Yes
Set terminal radio ON timer for 1 second. (Radio is now ON.)

Fig.30